4.5 Data Sources (continued)

Figure 4-3. Price and Quantity Indexes for Capital Input

	Item	Monthly Report	Years	Page or Schedule	Line	Col.
1.	Plant Investment (A06Y-A31Y & L06Y-L31Y)	QR2A	71-82	1 & 2	—	A
2.	Telephone Price Index (A115Y-A335Y)	Bell System Telephone Plant Indexes (TPI)*				
3.	Constant Dollar Stock-Benchmark (E114Q-E334Q & F114Q-F334Q)	Christensen, Christensen & Schoech - 1981*				
4.	Cost of Capital (A528Q)	Bell System Historical Embedded Cost of Capital 9.5 percent - 1Q & 2Q of '72 10.5 percent - 3Q & 4Q of '72 through '74 12.0 percent - '75 through 1Q of '80 14.5 percent - 2Q of '80 through 1Q of '81 15.25 percent - 2Q of '81 through 1Q of '82 16.5 percent - 2Q of '82 through 4Q of '82				
5.	Taxes (A411Y, A413Y, A414Y, A416Y, & A418Y)	Bell System Statistical Manual*				
6.	Revenues - Local Interstate (A701M & L701M)	MR4	72-74	1	26	A
			75	1	30	A
			76	1	32	A
			77 & 78	1	34	A
			79	2	21	A
			80-83	3	10	A

4.5 Data Sources (continued)

Figure 4-3. Price and Quantity Indexes for Capital Input (continued)

	Item	Monthly Report	Years	Page or Schedule	Line	Col.
7.	Revenues - Local Intrastate (A702M & L702M)	MR4	72-74	1	27	A
			75	1	31	A
			76	1	33	A
			77 & 78	1	35	A
			79	2	22	A
			80-83	3	11	A
8.	Revenues - MTS Interstate (A703M & L703M)	MR4	72-78	2	5	A
			79	2	28	A
			80-83	3	25	A
9.	Revenues - MTS Intrastate (A704M & L704M)	MR4	72-78	2	6	A
			79	2	29	A
			80-83	3	37	A
10.	Revenues - WATS Interstate (A705M & L705M)	MR4	72-78	2	11	A
			79	2	34	A
			80-83	4	6	A
11.	Revenues - WATS Intrastate (A706M & L706M)	MR4	72-78	2	12	A
			79	2	35	A
			80-83	4	14	A
12.	Revenues - PL Interstate (A707M & L707M)	MR4	72-74	2	34	A
			75-78	2	36	A
			79	3	23	A
			80,81,83	4	30	A
			82	4	31	A

4.5 Data Sources (continued)

Figure 4-3. Price and Quantity Indexes for Capital Input (continued)

	Item	Monthly Report	Years	Page or Schedule	Line	Col.
13.	Revenues - PL Intrastate (A708M & L708M)	MR4	72-74	2	35	A
			75-78	2	37	A
			79	3	24	A
			80 & 81	5	14	A
			82 & 83	5	15	A
14.	Revenues - Other Toll Interstate (A709M & L709M)	MR4	72-78	Data Not Available		
			79	3	30	A
			80 & 81	5	22	A
			82 & 83	5	23	A
15.	Revenues - Other Toll Intrastate (A710M & L710M)	MR4	72-74	2	37	A
			75	2	39	A
			76-78	2	41	A
			79	3	31	A
			80 & 81	5	32	A
			82 & 83	5	33	A
16.	Revenues - Misc. Intrastate (A711M & L711M)	MR4	72-75	3	6	A
			76-78	3	7	A
			79	4	17	A
			80 & 81	6	16	A
			82	6	15	A
			83	6	16	A
17.	Revenues - Total Interstate (A712M & L712M)	MR4	72-75	3	7	A
			76-78	3	8	A
			79	4	18	A
			80	6	20	A
			81 & 83	6	17	A
			82	6	16	A

4.5 Data Sources (continued)

Figure 4-3. Price and Quantity Indexes for Capital Input (continued)

	Item	Monthly Report	Years	Page or Schedule	Line	Col.
18.	Revenues - Total Intrastate (A713M & L713M)	MR4	72-75	3	8	A
			76-78	3	9	A
			79	4	19	A
			80	6	21	A
			81 & 83	6	18	A
			82	6	17	A
19.	Price Indexes (A721M, A723M - A727M, & A731M)	Price Indexes for Selected Telephone Services*				
Network Variable - Main and Equiv. Main Telephones						
1.	In Service at End of Year (B905Y)	MR7	72-83	2	38	07
2.	Net Gain Monthly (B903M)	MR7	72-83	2	19	04

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis

BOC RAW MATERIALS INPUT

	Cost	Price	Quantity
1Q72	528.4126	.987000	535.3726
2Q72	539.9160	.994000	543.1750
3Q72	491.6489	1.003000	490.1782
4Q72	546.8987	1.016000	538.2864
1Q73	579.1868	1.031000	561.7717
2Q73	607.9526	1.049000	579.5544
3Q73	640.8398	1.069000	599.4761
4Q73	620.4929	1.088000	570.3059
1Q74	643.0303	1.115000	576.7090
2Q74	692.4280	1.140000	607.3928
3Q74	645.1045	1.173000	549.9609
4Q74	615.8218	1.208000	509.7861
1Q75	697.9553	1.231000	566.9824
2Q75	766.0432	1.249000	613.3252
3Q75	689.1270	1.274000	540.9160
4Q75	716.7209	1.297000	552.5991
1Q76	809.4497	1.310000	617.9004
2Q76	885.6140	1.325000	668.3882
3Q76	787.8403	1.342000	587.0642
4Q76	888.3057	1.365000	650.7734
1Q77	980.0745	1.368000	716.4287
2Q77	1024.899	1.390100	737.2847
3Q77	1023.220	1.410300	725.5337
4Q77	901.8958	1.432400	629.6396
1Q78	1040.848	1.451200	717.2329
2Q78	1245.360	1.488900	836.4299
3Q78	1046.979	1.520200	688.7119
4Q78	1266.286	1.553800	814.9607
1Q79	1166.220	1.586000	735.3213
2Q79	1435.940	1.618500	887.2043
3Q79	1322.671	1.651200	801.0361
4Q79	1351.127	1.680500	804.0032
1Q80	1474.560	1.719400	857.6013
2Q80	1606.406	1.764600	910.3516
3Q80	1558.196	1.802400	864.5120
4Q80	1461.047	1.851300	789.2007
1Q81	1650.115	1.900100	868.4358
2Q81	1996.177	1.930300	1034.128
3Q81	1803.223	1.977000	912.1006

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

BOC RAW MATERIALS INPUT (continued)

	Cost	Price	Quantity
4Q81	1808.613	2.016900	896.7292
1Q82	1801.941	2.039800	883.3911
2Q82	2085.605	2.067700	1008.659
3Q82	1975.173	2.085300	947.1887
4Q82	2171.331	2.102700	1032.639

BOC LABOR INPUT

	Cost	Price	Quantity
1Q72	1765.356	.582221	3032.109
2Q72	1810.603	.598196	3026.773
3Q72	1924.220	.614171	3133.036
4Q72	1941.337	.630146	3080.771
1Q73	1931.820	.646122	2989.870
2Q73	1972.704	.662097	2979.479
3Q73	2054.813	.678549	3028.244
4Q73	2222.905	.695478	3196.227
1Q74	2163.340	.712407	3036.664
2Q74	2207.967	.729336	3027.367
3Q74	2370.774	.750419	3159.267
4Q74	2522.429	.775657	3251.990
1Q75	2471.091	.800895	3085.413
2Q75	2500.829	.826133	3027.152
3Q75	2720.461	.851963	3193.166
4Q75	2781.950	.878388	3167.110
1Q76	2778.135	.904812	3070.401
2Q76	2776.887	.931236	2981.938
3Q76	3017.658	.951392	3171.835
4Q76	3062.147	.965280	3172.290
1Q77	3011.135	.979168	3075.198
2Q77	3066.781	.993056	3088.226
3Q77	3219.575	1.009310	3189.878
4Q77	3517.586	1.027930	3422.008
1Q78	3490.049	1.046550	3334.814
2Q78	3427.877	1.065170	3218.149
3Q78	3754.593	1.089518	3446.106

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

BOC LABOR INPUT (continued)

	Cost	Price	Quantity
4Q78	3813.070	1.119595	3405.760
1Q79	4011.239	1.149670	3489.036
2Q79	3949.026	1.179746	3347.354
3Q79	4223.789	1.209323	3492.688
4Q79	4450.660	1.238400	3593.878
1Q80	4412.195	1.267478	3481.082
2Q80	4427.055	1.296556	3414.474
3Q80	4710.168	1.330338	3540.580
4Q80	4996.453	1.368823	3650.181
1Q81	4808.379	1.407310	3416.718
2Q81	5135.848	1.445795	3552.265
3Q81	5485.918	1.506456	3641.603
4Q81	5740.953	1.589294	3612.265
1Q82	6038.332	1.672132	3611.156
2Q82	6147.578	1.754971	3502.953
3Q82	6282.742	1.837807	3418.610
4Q82	6495.535	1.920645	3381.956

BOC CAPITAL INPUT

	Cost	Price	Quantity
1Q72	2046.480	.719819	2843.048
2Q72	2100.603	.730493	2875.596
3Q72	2364.128	.811590	2912.958
4Q72	2424.438	.822146	2948.914
1Q73	2303.562	.765510	3009.187
2Q73	2359.148	.773903	3048.378
3Q73	2427.883	.782263	3103.667
4Q73	2513.018	.797785	3149.994
1Q74	2381.146	.739707	3219.041
2Q74	2474.836	.759380	3259.024
3Q74	2570.823	.779000	3300.158

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4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

BOC CAPITAL INPUT (continued)

	Cost	Price	Quantity
4Q74	2671.156	.798472	3345.333
1Q75	2818.029	.832143	3386.471
2Q75	2908.351	.851027	3417.461
3Q75	3003.406	.869863	3452.736
4Q75	3092.826	.886975	3486.939
1Q76	3200.458	.912354	3507.912
2Q76	3275.193	.927765	3530.196
3Q76	3348.016	.943155	3549.803
4Q76	3427.245	.956399	3583.491
1Q77	3578.741	.988984	3618.602
2Q77	3636.561	1.000007	3636.536
3Q77	3712.200	1.010963	3671.943
4Q77	3766.016	1.020079	3691.888
1Q78	4026.038	1.073144	3751.629
2Q78	4082.895	1.080308	3779.380
3Q78	4158.027	1.087370	3823.931
4Q78	4256.109	1.098761	3873.554
1Q79	4548.012	1.158528	3925.679
2Q79	4663.520	1.174543	3970.499
3Q79	4782.492	1.190529	4017.118
4Q79	4924.309	1.209463	4071.485
1Q80	5068.105	1.226436	4132.383
2Q80	6204.191	1.493225	4154.895
3Q80	6396.094	1.518648	4211.703
4Q80	6605.645	1.547223	4269.355
1Q81	6617.488	1.527365	4332.617
2Q81	7155.828	1.635866	4374.336
3Q81	7351.297	1.668084	4407.031
4Q81	7574.059	1.700891	4452.996
1Q82	7340.156	1.630826	4500.883
2Q82	8128.988	1.800749	4514.227
3Q82	8318.906	1.834209	4535.418
4Q82	8514.738	1.867701	4558.941

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

BOC OUTPUT

	Value	Price	Quantity
1Q72	4654.367	.819853	5677.074
2Q72	4738.543	.829374	5713.395
3Q72	4926.199	.831557	5924.066
4Q72	5076.086	.833275	6091.727
1Q73	5207.426	.839864	6200.320
2Q73	5407.211	.844675	6401.531
3Q73	5506.188	.849414	6482.332
4Q73	5696.895	.863652	6596.281
1Q74	5867.375	.876349	6695.254
2Q74	6075.199	.878426	6916.008
3Q74	6178.871	.883236	6995.719
4Q74	6267.734	.890936	7035.004
1Q75	6340.863	.905508	7002.551
2Q75	6697.129	.925178	7238.742
3Q75	6875.359	.937018	7337.492
4Q75	7080.133	.951358	7442.129
1Q76	7307.281	.971626	7520.668
2Q76	7580.551	.987170	7679.070
3Q76	7790.965	.994356	7835.188
4Q76	7865.410	.996897	7889.895
1Q77	8141.727	.998660	8152.652
2Q77	8386.500	1.000005	8386.457
3Q77	8605.477	1.001276	8594.512
4Q77	8873.066	1.007419	8807.727
1Q78	9193.645	1.015010	9057.691
2Q78	9501.496	1.017142	9341.363
3Q78	9751.922	1.023353	9529.387
4Q78	9930.906	1.030796	9634.215
1Q79	10246.26	1.029173	9955.824
2Q79	10478.34	1.026849	10204.36
3Q79	10836.11	1.029505	10525.56
4Q79	10965.96	1.035787	10587.09
1Q80	11360.30	1.037848	10946.02
2Q80	11669.23	1.047080	11144.55
3Q80	12180.69	1.059556	11496.04
4Q80	12442.04	1.084074	11477.11
1Q81	12667.80	1.098570	11531.17
2Q81	13225.96	1.110668	11908.11
3Q81	14168.22	1.189252	11913.56

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

BOC OUTPUT (continued)

	Value	Price	Quantity
4Q81	14384.39	1.222916	11762.37
1Q82	14642.99	1.229872	11906.11
2Q82	15119.58	1.255279	12044.80
3Q82	15439.10	1.268556	12170.61
4Q82	15567.82	1.295059	12020.93

	R&D Index	Telephones
1Q72	4.382000	59.39091
2Q72	4.395000	59.86763
3Q72	4.408000	60.40915
4Q72	4.421000	61.19405
1Q73	4.434000	61.91853
2Q73	4.448000	62.42163
3Q73	4.461000	62.98323
4Q73	4.474000	63.71693
1Q74	4.488000	64.35242
2Q74	4.502000	64.80257
3Q74	4.516000	65.28922
4Q74	4.530000	65.85225
1Q75	4.545000	66.26042
2Q75	4.559000	66.55595
3Q75	4.574000	67.02992
4Q75	4.589000	67.70898
1Q76	4.604000	68.34224
2Q76	4.618000	68.78188
3Q76	4.633000	69.32147
4Q76	4.648000	70.06708
1Q77	4.662000	70.72516
2Q77	4.677000	71.21371
3Q77	4.691000	71.83833
4Q77	4.705000	72.72694
1Q78	4.719000	73.56938
2Q78	4.733000	74.22380
3Q78	4.746000	74.96346
4Q78	4.760000	75.89328

4.5 Data Sources (continued)

Figure 4-4. Data Used in Regression Analysis (continued)

	R&D Index	Telephones
1Q79	4.773000	76.74652
2Q79	4.786000	77.37247
3Q79	4.800000	78.06540
4Q79	4.813000	78.92227
1Q80	4.826000	79.67876
2Q80	4.839000	80.18176
3Q80	4.853000	80.67033
4Q80	4.866000	81.38641
1Q81	4.879000	82.05638
2Q81	4.892000	82.50963
3Q81	4.906000	83.02281
4Q81	4.919000	83.60922
1Q82	4.932000	83.95763
2Q82	4.944000	84.08511
3Q82	4.957000	84.28368
4Q82	4.970000	84.61533

5.0 APPLICATIONS

5.1 Marginal Cost of Interstate Access Services

As explained in previous sections, the purpose of this study was to develop an econometric cost model that could be used to estimate a marginal cost associated with providing interstate access services. In Section 3.0, the coefficient of elasticity for total operating expenses with respect to total output, K, was developed from the aggregate BOC model. The following analysis demonstrates how K can be used to produce a marginal cost for interstate access service:

$$K = \frac{\delta \log C_T}{\delta \log Q_T}.$$

where C_T = total company operating expenses, and
Q_T = aggregate demand.

For a specific service (interstate access), the coefficient of elasticity for total operating expenses is defined as:

$$K_s = \frac{\delta \log C_T}{\delta \log Q_s}.$$

where Q_s = demand for interstate access service.

From Section 3.0,

$$K_s = K \times \frac{R_s}{R_T}.$$

where R_s and R_T are the interstate access service revenues and total service revenues, respectively.

Substituting for K_s:

$$\frac{\delta \log C_T}{\delta \log Q_s} = K \times \frac{R_s}{R_T}. \qquad \text{Equation (1}$$

Since $\frac{\delta \log C_T}{\delta \log Q_s} = \frac{Q_s}{C_T} \times \frac{\delta C_T}{\delta Q_s}$, Equation (1) can be rewritten in terms of a marginal cost, $\frac{\delta C_T}{\delta Q_s}$,

where

$$\frac{\delta C_T}{\delta Q_s} = \frac{C_T}{Q_s} \times K \times \frac{R_s}{R_T}. \qquad \text{Equation (2}$$

Multiplying both sides of Equation (2) by $\frac{1}{P_s}$, where P_s is the price of interstate access service, will convert the demand Q_s into a revenue, R_s, since $R_s = P_s \times Q_s$.

The marginal cost in terms of a revenue quantity, $\frac{\delta C_T}{\delta R_s}$, is given by:

$$\frac{\delta C_T}{\delta R_s} = \frac{C_T}{R_s} \times K \times \frac{R_s}{R_T}$$

or

$$\frac{\delta C_T}{\delta R_s} = K \times \frac{C_T}{R_T}. \qquad \text{Equation (3)}$$

Equation (3) indicates that the marginal cost with respect to service revenue quantity is constant across services. This property of the model is a result of the assumption that service prices are proportional to service marginal costs. Equation (3) can be used to calculate changes in total costs resulting from a given change in service demand expressed in terms of revenues.

5.2 Marginal Cost Factor for Use in Interstate Access Service Filing

It has been shown in the above analysis that a marginal cost can be developed from the econometric cost model. This marginal cost is based on costs and revenues for the aggregate of the BOCs as of 1982 (the last actual set of historical data used in this analysis). To be useful in supporting cost effect calculations in future interstate access service filings, the following factors must be considered in developing a future test year marginal cost:

(1) Development of appropriate cost and price deflators for projecting 1982 marginal costs
(2) Inclusion of gross receipts tax effects on marginal costs
(3) Methods for identifying the marginal cost portion to be assigned to the interstate jurisdiction in accordance with FCC rules (Part 67).

1. Projection of 1982 Marginal Cost

The interstate access service marginal cost, MC_{82}, can be projected to future test periods by multiplying MC_{82} by a ratio of the Gross National Product (GNP) implicit price deflator to the weighted interstate telephone service price index. The GNP price deflators for 1982 and 1986 were obtained from the U.S. Bureau of Economic Affairs. Table 5-1 shows the revenue weights by interstate service for 1982. These weights are used in Table 5-2 to calculate the weighted interstate price index used in the projection of the 1982 marginal cost value.

Once the GNP deflators and the weighted interstate telephone price indexes are developed, the projected marginal cost can be calculated as follows:

$$MC_{82} = \frac{\delta C_T}{\delta R_s} = K \times \frac{C_{T82}}{R_{T82}}.$$

where K = coefficient of elasticity total op exp with respect to total output = .3810 [from model]

C_T = Total Operating Expense [1982] = $32,998 million

R_T = Total Revenues [1982] = $60,769 million.

$$MC_{82} = \$.20689$$

$$MC_{86} = MC_{82} \times \frac{(1986\ \text{GNP Deflator})}{(1982\ \text{GNP Defaltor})} \div \frac{(1986\ \text{IS Tel. Price Index})}{(1982\ \text{IS Tel. Price Index})}$$

$$MC_{86} = .20689 \times (1.138) \div (.9307)$$

$$MC_{86} = \$.2529$$

2. Marginal Cost Assigned Interstate through FCC Rules (Part 67)

The marginal cost developed in the projection above provides the change in total company operating expenses with respect to changes in interstate revenues. To develop the cost effects on the interstate jurisdiction, the total company marginal costs must be apportioned, using Part 67 rules, to the state and interstate jurisdiction. Analysis of the Part 67 rules indicates that the predominance of the subcategories of operating expenses are apportioned based on either a usage distribution between state and interstate, an investment distribution between the two jurisdictions, or on distributions developed from other subcategories of operating expenses. Virtually none of the operating expenses are directly assigned to the jurisdictions. (As a result, if for interstate demand response purposes the relative usage between state and inter-state is kept at the same level as for the base forecast condition, and the short run change in investment resulting from demand response is zero, then the marginal operating expense cost can be distributed between state and interstate in the same manner as in the base forecast.) Specifically, the appropriate interstate factor to apply to the total company marginal cost is developed by dividing the base forecast total interstate operating expense by the base forecast total company operating expense. The subcategories of operating expenses to be used in this calculation are those considered in the econometric model developed in this paper. In particular, they are:

- Maintenance Expense (MTCE)
- Traffic Expense (Traff.)
- Commercial Expense (Comm.)
- General Office Expense (Gen. Off.)
- Other Operating Expense (Other).

Using the individual prospective total company budget view and the prospective interstate budget view, the interstate operating expense factor, ISF, can be calculated as:

$$ISF = \frac{\text{IS Base Forecast (MTCE + Traff. + Comm. + Gen. Off. + Other)}}{\text{Total Base Forecast (MTCE + Traff. + Comm. + Gen. Off. + Other)}}$$

The marginal cost allocated interstate, $ISMC_{86}$, is given by:

$$ISMC_{86} = ISF \times MC_{86}.$$

3. Marginal Cost Tax Effects

The total marginal costs and the interstate portion developed above do not consider any tax effects that would be introduced by changes in the company's operating expenses. These effects must be developed outside the model and added to the change in operating expenses to obtain a total cost change including taxes.

The only taxes that will affect the cost change are those taxes that are calculated on a gross revenues or gross receipts basis. Taxes based on net income, such as federal taxes, will not cause a change in the interstate costs because the change in operating expenses will be included in the revenue requirement that is used to calculate the past demand response rates. Since these new rates will be set to generate revenues that recover costs including the adjusted operating expenses, the post-demand response net income level (Revenues = Costs) will be the same as the predemand response net income level.

The adjustment to include the effects of gross revenues taxes on the marginal costs can be developed by multiplying $ISMC_{86}$ by one plus the appropriate gross revenues tax factor for each study area:

$$ATISMC = ISMC_{86} \times (HGRT)$$

where ATISMC = after tax IS marginal cost
GRT = gross revenues tax factor (study area specific)
HGRT = 1 + GRT.

Table 5-1. 1982 Interstate (IS) Revenue Weights by Service

Service	Revenues	Fraction of Total
MTS	11,120.4 (million)	.6640
WATS	3,226.5 (million)	.1926
Private Line	2,401.2 (million)	.1434
Total	16,748.1 (million)	1.0000

Table 5-2. Weighted IS Price Indexes for 1982 and 1986*

Yr	MTS		WATS		PL		Total IS Price Index
	Price Index	Wtg	Price Index	Wtg	Price Index	Wtg	(g) = a×b+c×d+e×f
	(a)	(b)	(c)	(d)	(e)	(f)	
1982	100.0	.6642	100.0	.1926	100.0	.1434	100.0
1986	91.3	.6642	88.2	.1926	107.7	.1434	93.07

* Telephone Price Indexes, *Bureau of Labor Statistics*

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6.0 CONCLUSIONS AND FUTURE DIRECTIONS

This paper described an econometric study of the marginal cost of switched and special access. Ninety-five percent confidence intervals for marginal cost of both access services is (8.74,32.62) cents per dollar of revenue or (.0109,.0407) cents per switched access minute. With other required adjustments, the marginal cost of a switched access minute appears to be roughly 1.5 cents. This value is considerably below the cost of switched access in LEC access tariffs: these average roughly 6 cents per minute at present. Prices in excess of marginal cost are a sign of the potential profitability of competitive entry, and one would expect entry and competitive pressure when prices are on the order of four times marginal cost.

Future econometric work should focus on relaxing some of the restrictive assumptions the current study makes. Foremost is the assumption that access in 1986 is identical to interstate services of the predivestiture BOCs in the 1970s. Once some historical data has been obtained in the post-divestiture environment, a cost function similar to equations (1) and (2) should be re-estimated.[31] Since short time series data will not contain enough variation to estimate a flexible function very precisely, a pooled time-series cross-section approach should be considered.

The next most restrictive assumption is the single output formulation of the cost function which is restrictive in the sense that it forces the marginal cost measure for all services to be the same.[32] Such results cannot be used to assess the relative competitive positions of LEC switched and special access services without some further physical dimension of output. Unfortunately, estimation of multi-output cost functions - though straightforward theoretically - has not been successful using short time-series data.[33] Possibly, the additional variation in output obtainable from pooled time-series and cross-section data might make distinct statistical estimates of cost elasticities of different services possible.

Finally, the assumption that all predivestiture BOCs possessed the same technology and faced the same factor prices should be relaxed. To this end, individual companies can take the data and methods presented in this study and estimate a cost function from predivestiture data that is specific to one company. For use in interstate access tariff filings, this would probably be preferable to the current reliance on a national study.

31. Although it is tempting to estimate *directly* the marginal cost of access by estimating a cost function for access, this is unlikely to be meaningful. The process which assigns costs to services (Parts 67 and 69 of the Commission's Rules) has no economic validity and it is difficult to assume that a firm would try to minimize that cost, given factor prices and levels of interstate demand.

32. It is not restrictive in the sense that any multi product monopolist will price so that the marginal cost associated with an additional dollar's revenue is one dollar for every service.

33. Christensen, Christensen, and Schoech (1983), *op. cit.*, or Nadiri and Schankerman (1981), *op. cit.*

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Attachment A

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